

AMENDMENTS TO THE DRAWINGS:

Applicant submits herewith two sheets of new drawings, specifically replacement sheets for Figures 1 and 4. The new drawings include the reference numerals mentioned in the description. No new matter was added.

REMARKS

Applicant has now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of October 4, 2007. In this response, Applicant amended selected claims and presents clarifying remarks believed to remedy the Examiner's rejections and place the claims in condition for allowance.

Reexamination and reconsideration are respectfully requested.

I. Oath/Declaration

The Examiner indicated that the oath/declaration is defective because it incorrectly listed the year of the US Provisional Application as "2004" instead of "2003". A corrected oath/declaration is attached to this Response.

II. Drawings

The Examiner objected to the drawings as failing to comply with 37 CFR 1.84(p)(5) because they did not include certain reference signs mentioned in the description. Corrected drawing sheets which include the reference numerals identified in the Office Action are attached to this Response.

The Examiner objected to the drawings as failing to comply with 37 CFR 1.84(p)(5) because they included certain reference characters not mentioned in the description. Paragraph [0032] of the specification has been amended to overcome this objection. No new matter has been added.

III. Specification

The Examiner objected to the disclosure because of certain informalities. These informalities have been addressed in the amendments to the specification. The Examiner's assistance in identifying these minor discrepancies is appreciated.

IV. Claim Rejections

Claims 1-4, 7-8, and 10 were rejected under 35 U.S.C. § 102(b) as being anticipated by the publication "An Experimental Study of Cavitation in A Mixed Flow [Pump] Impeller" (hereafter "the Publication"). Applicant submits that amended claim 1 differs from the impeller shown in the Publication.

Claim 1, as amended, calls for a high performance inducer for pumping cryogenic two phase fluids from reservoirs. The inducer includes a hub including a first portion having a first diameter and a second portion having a second, larger diameter. A plurality of primary blades each having a generally helical conformation is circumferentially disposed about the hub. Each primary blade has a first length. A plurality of second blades is circumferentially disposed about the hub. Each secondary blade is interposed between two primary blades and has a second length different than the length of the primary blades.

Figure 1 of the Publication shows three impellers, to wit, impeller A, impeller B, and impeller C. Each impeller includes a hub and a plurality of blades having a helical conformation. However, the blades of each impeller have similar length and shape. Thus, Applicant submits that the impellers shown in Figure 1 of the Publication have a plurality of primary blades, each primary blade having a first length. No secondary blades are shown in Figure 1, particularly, no secondary blades which are circumferentially disposed about the hub, interposed between two primary blades and having a second length different than the first length. Accordingly, Applicant submits that amended claim 1, and the claims dependent or ultimately dependent thereon, define over the Publication, whether taken alone or in combination with any of the remaining art of record.

Regarding claim 3, Applicant submits that impellers A-C of the Publication fail to teach a radial depth of the plurality of primary and secondary blades being substantially greater at a first portion of the hub than at a second portion of the hub. As shown in Figure 1, each blade of each impeller has a radial depth which is smaller at the first portion of the hub than at the second portion of the hub. Particularly, and with reference to impeller A, each blade has a helical conformation which extends farther

from the hub as the blade winds around the hub. Accordingly, Applicant submits that claim 3 is in condition for allowance.

Regarding claim 4, Applicant submits that impellers A-C shown in the Publication fail to teach that an outer diameter of each primary blade and each second blade is generally constant from a leading edge to a trailing edge. Again, as shown in Figure 1, each impeller has a plurality of primary blades, each primary blade having the same length and conformation. Assuming, *arguendo*, that the hub of each impeller increases in diameter from a first portion to a second portion, the leading edge of each blade does not extend as far from the hub as the trailing edge of each blade. As shown in Figure 1, as each blade of impellers A-C extends circumferentially about the hub, it extends outwardly from the hub. As such, the outer diameter of each blade is not generally constant. Accordingly, claim 4 is in condition for Allowance.

Claims 1 and 2 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kun (U.S. Patent No. 4,904,158).

As indicated previously, claim 1 has been amended to call for a plurality of primary blades having a generally helical conformation circumferentially disposed about the hub. Applicant submits that Kun fails to show a plurality of primary blades having such a helical conformation. Applicant submits that the Examiner concedes that Kun fails to disclose such a limitation based on the fact that the Office Action fails to identify Kun as anticipating, for example, dependent claim 7 which further defines the primary blades as having a general helical conformation. Accordingly, Applicant submits that Kun fails to anticipate claim 1, as amended, and claim 2 dependent thereon.

Claims 1-3 and 7 were rejected under 35 U.S.C. § 102(b) as being anticipated by Meng (U.S. Patent No. 6,435,829).

With reference to Figures 1 and 7 of Meng, Meng discloses an inducer 10 including a hub portion 12 and a plurality of blades 14 which cooperate to define a plurality of flow passages 16. Each of the plurality of blades 14 includes a suction side 18 and a pressure side 20. Blades 14 have a helical conformation and are circumferentially disposed about the hub 12. Applicant submits that the blades 14 of Meng are not a plurality of primary blades having a first length and a plurality of secondary blades interposed between two primary blades and having a second length.

Rather, as shown in Figures 1 and 7 of Meng, the plurality of blades 14 have differing lengths, the primary blade located at a first portion of a hub being smaller than the primary blade located at a second portion of the hub. Accordingly, Applicant submits that claim 1, as amended, and claims dependent or ultimately dependent thereon, define over Meng whether it is taken alone or in combination with any remaining prior art.

Claims 1-4, 7, 10, 13-15 and 17-18 are rejected under 35 U.S.C. § 102(b) as being anticipated by Coats (U.S. Patent No. 1,874,450).

With reference to Figure 1 and 2 of Coats, Coats discloses an impeller 4 including vanes 5 inclined in an opposite direction to that of vanes 3 located on a casing 2 which surrounds the impeller. The impeller has a conical shaped hub 6 such that the blades are wider at their bottoms than at their tops.

Regarding claim 1, as amended, Applicant submits that Coats fails to disclose a plurality of primary blades having a first length and a plurality of secondary blades interposed between two primary blades and having a second length. With particular reference to Figure 2 of Coats, the blades 5 have the same length and conformation. Thus, Coats discloses a plurality of primary blades having a first length. No secondary blades having a second length are shown in Coats. The Examiner identifies the plurality of primary blades as being blades 5 of Coats. The Examiner further defines the plurality of secondary blades as being the same blades 5 of Coats. However, because each blade 5 has the same length and conformation, there are no secondary blades interposed between two blade 5 of Coats which has a second length different than the first length. Accordingly, Applicant submits that claim 1, as amended, and claims dependent or ultimately dependent thereon, define over Coats whether taken alone or in combination with the prior art.

Regarding claim 10, Applicant submits that because Coats fails to disclose a plurality of secondary blades, Coats further fails to disclose a leading edge of a secondary blade being circumferentially spaced generally 60 degrees from a leading edge of an adjacent primary blade. Again, Coats only discloses a plurality of blades 5 having the same shape, size, and length disposed about a hub 4. Accordingly, claim 10 is in condition for allowance.

Regarding claim 13, Applicant submits that claim 13 differs from the art taught in Coats.

Claim 13, which has not been amended in response to the Office Action, calls for an inducer comprising a hub, a plurality of primary blades extending from the hub and having a generally helical conformation circumferentially disposed about the hub. Secondary blades extending from the hub are interposed between the plurality of primary blades. Again, with reference to Figures 1 and 2 of Coats, Coats discloses a hub for a plurality of blades 5 disposed about the hub. The blades 5 are of the same shape and size. As such, a blade 5 which is interposed between blades 5 having the same shape and size is not a claimed secondary blade. Accordingly, Applicant submits that claim 13, and claims dependent or ultimately dependent thereon, define over Coats whether taken alone or in combination with remaining art.

Regarding claim 17, as amended, Applicant submits that the art differs from that taught in Coats.

Claim 17, as amended, now calls for the secondary blades being shorter in length than the primary blades. As indicated previously, Coats discloses a plurality of blades 5, each having the same shape and size disposed about a hub 4. As such, Coats fails to disclose secondary blades being shorter in length than primary blades. Accordingly, Applicant submits that claim 17, as amended, and claims dependent or ultimately dependent thereon, define over Coats and are in condition for allowance.

V. Claim Rejections - 35 USC § 103

Claims 5-6 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Publication in view of Kato (U.S. Patent No. 5,947,684).

Applicant submits that Kato teaches away from the impellers shown in the Publication. Particularly, with reference to Figure 1 of the Publication, impellers A-C each disclose a hub having a flattened top surface including apertures which allow the hub to be mounted to, presumably, a shaft. Kato shows an impeller 12 having a hub which includes a generally rounded end 19. Applicant submits that if the rounded end 19 of Kato was included on the hubs of impellers A-C of the Publication, then the impeller hubs would not be able to be mounted to a shaft. As such, the rounded end 19

of Kato teaches away from the hub ends of impellers A-C which are flattened so that the impellers can be attached to a shaft via the apertures located on a top surface of each of the hubs. Accordingly, claim 5 is in condition for allowance.

CONCLUSION

All formal and informal matters have been addressed. For the reasons detailed above, it is respectfully submitted all claims remaining in the application are now in condition for allowance. The foregoing comments do not require unnecessary additional search or examination.

In the event the Examiner believes a telephone call would expedite prosecution, he is invited to call the undersigned.

Respectfully submitted,

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